Texas Children's Hospital

DATE: June 2017

TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Skin & Soft Tissue Infection (SSTI)
Evidence-Based Guideline

Definition: Skin and soft tissue infection is a painful, erythematous infection of the dermis and subcutaneous tissue that has poorly demarcated borders and is characterized by an inflammatory response including: erythema, edema, lymphangitis, and advancing borders. The most common manifestation is abscess. [1-4] Erysipelas is a form of cellulitis with marked superficial inflammation and sharply demarcated borders typically affecting the lower limbs and face. [2] Cellulitis, along with impetigo and folliculitis, is the 28th most common diagnosis in hospitalized patients. [3] *Staphylococcus aureus* is the most common cause of skin and soft tissue infection accounting for up to 50% of cases of cellulitis. [4] Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is of major concern accounting for approximately 50% of *S. aureus* isolated from hospitalized children in the geographic area surrounding Houston, Texas. [5-9] Among *S. aureus* causing skin and soft tissue infections at TCH, approximately 50% are methicillin-resistant. At TCH, among community-acquired MRSA causing SSTI, approximately 17% are clindamycin-resistant; among CA-MSSA SSTI, there is a similar rate of clindamycin resistance. [Unpublished TCH Data]

Pathophysiology: When squamous epithelial cells with strong intercellular bonds, part of the integumentary barrier, are compromised bacteria are allowed to enter the dermis. Cellulitis is more serious in patients with underlying diseases such as diabetes or patients who are immunocompromised. [10]

Inclusion Criteria
- Age >2 months

Exclusion Criteria
- Periorbital or perianal cellulitis
- Chronic wound
- Impetigo
- Folliculitis
- Fasciitis or deeper infection
- Lymphadenitis
- Diabetes
- Immunocompromise
- Sepsis
- Postoperative wound infection
- Infected animal bite
- Dental abscess
- Pregnancy

Differential Diagnosis
- Deeper infection (e.g., pyomyositis, septic arthritis, osteomyelitis)
- Thermal injuries
- Bug/Snake bites
- Sunburn, photodermatitis

Diagnostic Evaluation
Children with skin and soft tissue infection have a risk of progressing to septic shock.

Table 1. Vital Sign Changes of Sepsis [11]

Age	Heart Rate	Resp Rate	Systolic BP	Temp (°C)
0d - 1m	>205	>60	<60	<36 or >38
>1m - 3m	>205	>60	<70	<36 or >38
>3m - 1y	>190	>60	<70	<36 or >38.5
>1y - 2y	>190	>40	<70 + (age in yr x 2)	<36 or >38.5
>2y - 4y	>140	>40	<70 + (age in yr x 2)	<36 or >38.5
>4y - 6y	>140	>34	<70 + (age in yr x 2)	<36 or >38.5
>6y - 10y	>140	>30	<70 + (age in yr x 2)	<36 or >38.5
>10y - 13y	>100	>30	<90	<36 or >38.5
>13y	>100	>20	<90	<36 or >38.5

Table 2. Signs and Symptoms of Shock [11]

Exam Abnormalities			
	Cold Shock	**Warm Shock**	**Non-Specific**
Peripheral Pulses	Decreased or weak	Bounding	
Capillary Refill (central vs. peripheral)	≥3 sec	Flash (<1 sec)	
Skin	Mottled, cool	Flushed, ruddy, erythroderma (other than face)	Petechiae below the nipple, any purpura
Mental Status			Decreased, irritability, confusion, inappropriate crying or drowsiness, poor interaction with parents, lethargy, diminished arousability, obtunded

History: Assess for
- Traumatic skin injury, tinea infection, leg ulcers, boils, etc.
- Query patient/parent about bite wounds, marine exposures, possibility of foreign body that can serve as a nidus for cellulitis

Physical Examination
- Evaluate for cardinal signs of infection: erythema, tenderness, pain, warmth, induration/edema, and drainage/fluctuance

Critical Points of Evidence*

Evidence Supports

- Obtain an ultrasound only when the diagnosis is equivocal. [12-19] – Strong recommendation, moderate quality evidence
- Consider the following options for cellulitis: Clindamycin (no age restriction), trimethoprim-sulfamethoxazole (children >2 months), or doxycycline (children ≥8 years only). If streptococcal infection is suspected, consider an alternative antibiotic to trimethoprim-sulfamethoxazole; if streptococcal infection is diagnosed, use penicillin or amoxicillin. Use caution when selecting clindamycin due to increased resistance rates in *S. aureus* isolates at TCH. Consider flavoring if administering PO clindamycin. [12,13,20-31] – Weak recommendation, low quality evidence
- Consider the following options for erysipelas: Clindamycin (no age restriction) or doxycycline (children ≥8 years only). Consider flavoring if administering PO clindamycin. [12,13,20-31] – Weak recommendation, low quality evidence
- Consider the following options for well-drained abscesses with overlying cellulitis, well-drained abscesses >3 cm, or well-drained abscesses with systemic symptoms (e.g., fever, vomiting): PO trimethoprim-sulfamethoxazole (preferred antibiotic; children >2 months only), PO doxycycline (children ≥8 years only), or PO clindamycin (no age restriction). PO cephalexin is a reasonable option for treating MSSA if contraindications preclude administering any of these options. Abscesses caused by Group A streptococcus are uncommon but if streptococcal infection is suspected, consider an alternative antibiotic to trimethoprim-sulfamethoxazole; if streptococcal infection is diagnosed, use penicillin or amoxicillin. Use caution when selecting clindamycin due to increased resistance rates in *S. aureus* isolates at TCH. Consider flavoring if administering PO clindamycin. [12,13,20-31] – Weak recommendation, low quality evidence
- Consider IV vancomycin for the following: large abscess or abscess involving critical area (e.g., face, hand), worsening clinical status, or concern for progression. Administer IV vancomycin if toxic or ill-appearing. Add IV nafcillin if the patient's condition is severe. [12,13,20-31] – Weak recommendation, low quality evidence
- Consider admission for the following: systemic symptoms (significant fever, SIRS), rapidly expanding or large lesion, age <3 months, concern for inadequate drainage of large abscess, abscess location that requires subspecialty consult, unable to tolerate oral antibiotics, significant pain, failed treatment with 48 hours of appropriate antibiotics, or follow-up concerns. [12,13,20,31,32] – Weak recommendation, very low quality evidence
- Consider dilute bleach baths, especially in cases of multiple recurrences. [20,33-35] – Weak recommendation, low quality evidence
- Consider whole-body washing with chlorhexidine to prevent recurrent abscesses. [20,33,36-44] – Weak recommendation, moderate quality evidence

Evidence Against

- Do not routinely obtain blood cultures in children with SSTI. Obtain blood cultures in children with signs of systemic toxicity, rapidly spreading lesions, persistent fevers, or suspected deeper infection; consider obtaining blood cultures in children <3 months. [12,13,45-50] – Strong recommendation, very low quality evidence
- Do not obtain an ultrasound when the diagnosis is clear. [12-19] – Strong recommendation, moderate quality evidence
- Do not routinely administer antibiotics as an adjunct to I&D; consider administering antibiotics for systemic symptoms (e.g., fever, tachycardia, vomiting), overlying cellulitis, or abscess >3 cm. [12,13,20,51,52] – Strong recommendation, high quality evidence

Evidence Lacking/Inconclusive

- Consider additional imaging for admitted patients who are not improving on adequate antibiotics or if there is concern for new fluctuance or evolving abscess. [12,13] – Consensus recommendation
- Do not routinely use the following when administering antibiotics for SSTI: Linezolid (practical limitations) or IV trimethoprim-sulfamethoxazole. – Consensus recommendation
- Do not routinely administer prophylactic systemic antibiotics to prevent recurrence. [20,53] – Consensus recommendation

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Condition-Specific Elements of Clinical Management

Wound/Infection Management

- Measure and mark site and monitor for advancing area of involvement
- See treatment algorithm and antibiotic table for antibiotic options
- Monitor and manage pyrexia
- Elevate limb and use bed cradle, if applicable
- Utilize Contact Precautions for handling contaminated items
- If admitted, reevaluate patient frequently to determine need for further treatment or discharge readiness

Pain Management

- Assess need for pain management
- Provide oral/IV pain medications for I&D

Admission Criteria

Consider admission for:

- Systemic symptoms (significant fever, SIRS)
- Rapidly expanding or large lesions (>3 cm; significant cellulitis after abscess drainage)
- Age <3 months
- Concern for inadequate drainage of large abscess
- Abscess location that requires subspecialty consult
- Unable to tolerate oral antibiotics
- Significant pain
- Failed treatment with 48 hours of appropriate antibiotics
- Follow-up concerns

Discharge Criteria

- No fluctuance
- Erythema, size, and induration receding from outline
- Improving fever curve
- Tolerating oral intake
- Pain controlled with oral medications
- Ability to bear weight or use involved extremity

Consults/Referrals

- Consult surgery for I&D in the OR, if required

Prevention

- Strict handwashing
- Clean technique for dressing change

Measures

Process

- Type and duration of antibiotic administration (especially mupirocin and vancomycin)
- Appropriate laboratory tests and radiologic studies ordered
- Appropriate oral/IV pain management for I&D procedures performed outside of the OR
- Missed diagnosis of deeper process
- Use of dilute bleach baths
- Length of stay

Outcome

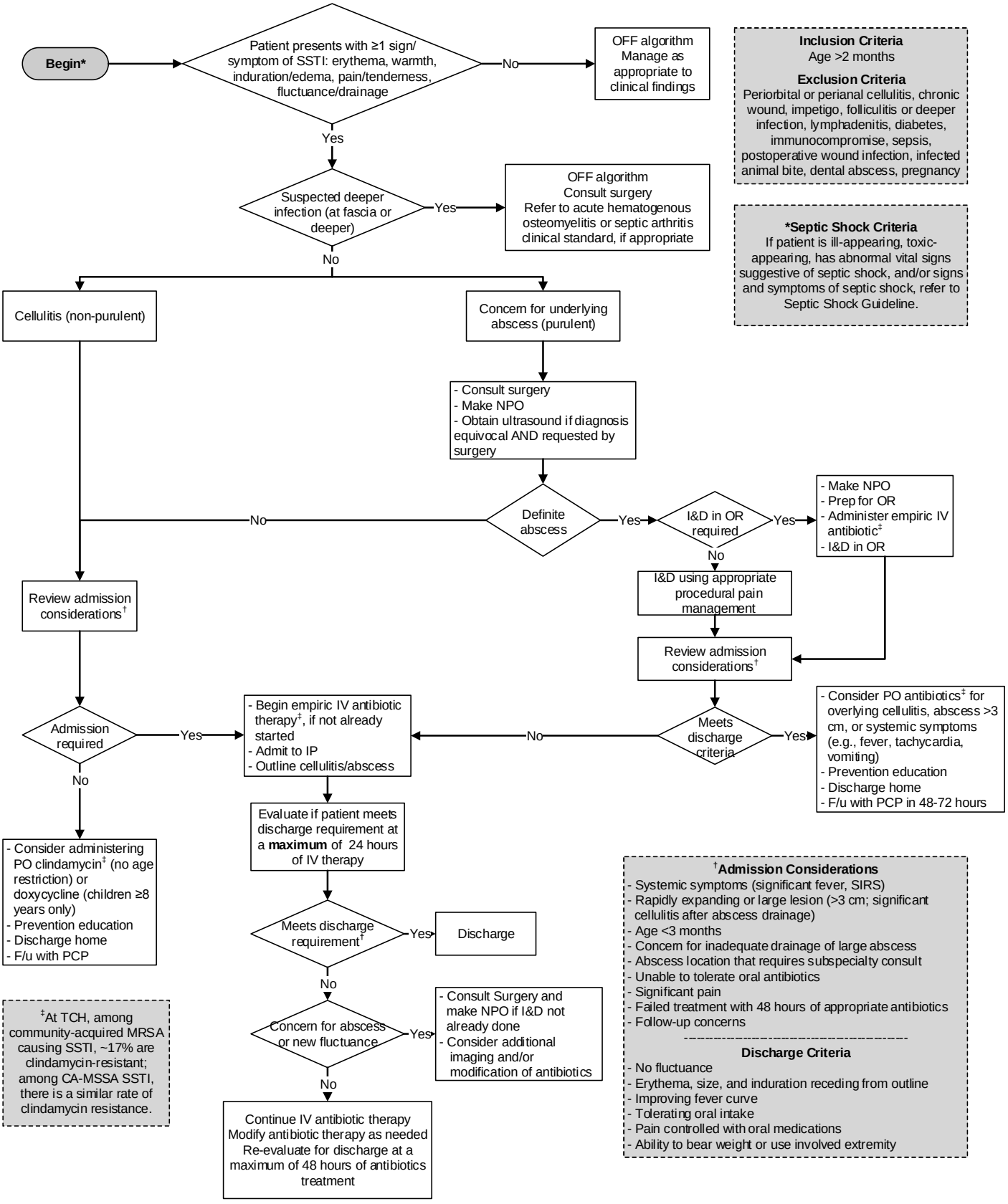
- EC visit within 7 days for SSTI
- Recurrent episodes requiring drainage

Antibiotic Table [54]

	Age Restrictions	Dose and Frequency
Trimethoprim (TMP) and Sulfamethoxazole (SMX) Simple SSTI (If proven group A strep, add PCN)	Children >2 months	ORAL: 8-12 mg TMP/kg/DAY divided every 12 h; **MAX:** 160 mg TMP/dose
Doxycycline Simple SSTI if suspect CA-MRSA	Children ≥8 years	ORAL: 2-4 mg/kg/DAY divided every 12-24 h; **MAX:** 100 mg/dose or 200 mg/DAY
Clindamycin (Refer to guidelines for clindamycin resistance rate)	None	ORAL: 10-13 mg/kg/dose every 8 h; **MAX:** 1.8 grams/DAY IV: 10-13 mg/kg/dose every 8 h; **MAX:** 1.8 grams/DAY
Cephalexin (For suspected/confirmed group A strep **and** MSSA)	None	ORAL: 25-50 mg/kg/DAY divided every 6 h; **MAX:** 500 mg/dose
Nafcillin (For suspected/confirmed MSSA)	None	IV: 100-150 mg/kg/DAY divided every 6 h; **MAX:** 12 grams/DAY
Vancomycin (For suspected/confirmed MRSA requiring IV therapy)	None	IV: 15 mg/kg/dose every 8h; **MAX:** 1 gram/dose For patients with invasive infection: 15 mg/kg/dose every **6** hours

DATE: June 2017

TCH Evidence-Based Outcomes Center
Clinical Algorithm for Skin & Soft Tissue Infection



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Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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The following financial and/or intellectual conflict was identified and addressed to ensure objectivity: Shabana Yusuf was the lead author of a study included in the literature review.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
   - IDSA (2014) Diagnosis and Management of Skin and Soft Tissue Infections; Children's Hospital of Philadelphia (2015) Cellulitis/Abscess, Suspected; Seattle Children's Hospital (2013) Cellulitis and Abscess
3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane
4. Critically Analyze the Evidence
   - 4 meta-analyses, 14 randomized controlled trials, and 20 nonrandomized studies
5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in an SSTI evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.
"Evidence Supports" provides evidence to support an intervention
"Evidence Against" provides evidence against an intervention.
"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence.*

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	**Type of Evidence**
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis and management of SSTI in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care, and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient family, to make the ultimate judgment regarding care.

Version History

Date	Comments
Jun 2010	Originally completed
Jun 2017	Updated
April 2018	Revised the algorithm and discharge criteria
Jan 2019	Revised the 'Vital Signs Changes of Sepsis' table